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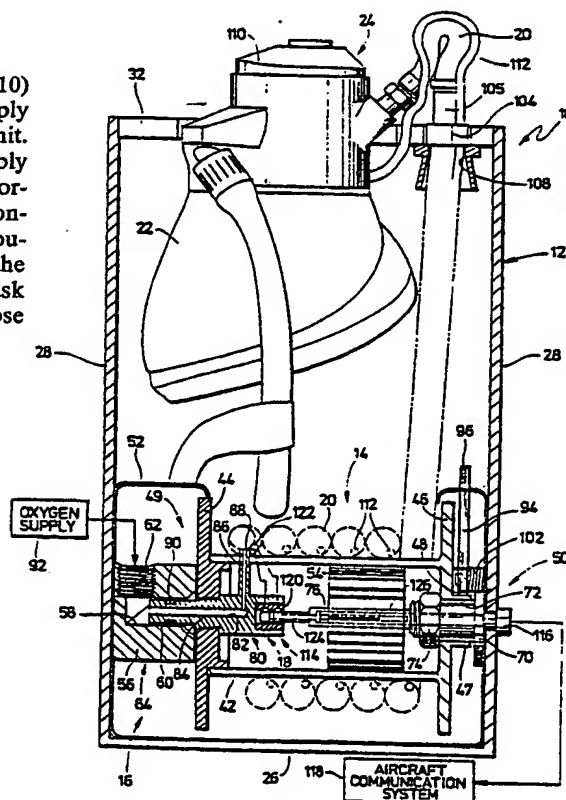
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(54) Title: CREW OXYGEN MASK AND HOSE STOWAGE UNIT

(57) Abstract

An aircraft oxygen mask (22) and supply hose stowage unit (10) is provided which retracts and conveniently stows the oxygen supply hose (20) as the mask is moved toward a stowage position on the unit. The preferred unit includes a housing (12) with a hose reel (14) rotatably mounted therein and a rotary oxygen connector (18) having a fixed portion (64) coupled with the housing (12) and presenting an inlet for connection to an oxygen source (92), and a rotary portion (80) fixedly coupled with the reel presenting an outlet. The oxygen hose interconnects the connector outlet (86) on the reel (14) and the mask (22) and as the mask (22) is moved toward the stowage direction the reel (14) wraps the hose (20) thereabout to conveniently stow the hose (20).



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## CREW OXYGEN MASK AND HOSE STOWAGE UNIT

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Background of the Invention1. Field of the Invention

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The present invention relates to an aircraft oxygen mask and supply hose stowage unit which retracts and conveniently stows the oxygen supply hose as the mask is moved from an in-use position to a stowage position on the unit. More particularly, the present invention concerns a housing having a rotatable reel contained therein which is biased in a stowage direction for wrapping the oxygen hose therearound in order to conveniently stow the hose and the mask when not in use.

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2. Description of the Prior Art

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A typical aircraft crew member's oxygen mask and accompanying oxygen supply hose are stowed in a box adjacent the crew member's seat. In order to use the oxygen mask, the crew member removes it from the box with the supply hose trailing along with it. When the oxygen mask is no longer needed, the crew member often lays the mask and oxygen supply hose on the deck adjacent the seat rather than neatly stowing them in the box because of inconvenience of doing so or because of insufficient time due to the demands of flying the aircraft. With the mask and supply hose lying on the floor, they are subject to damage, dirt, and may even present a tripping hazard.

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Summary of Invention

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The prior art problems as outlined above are solved by the aircraft oxygen mask and supply hose stowage unit of the present invention. That is to say, the unit hereof conveniently stows an oxygen

1 supply hose and an oxygen mask when no longer in use.

5 Broadly speaking, the preferred embodiment of the present invention includes a housing with a hose reel rotatably mounted therein. The preferred unit also includes a rotary oxygen connector which includes a fixed portion coupled with the housing having an inlet for coupling with an oxygen source, a rotary portion rotatably and fluidically coupled with the fixed portion and fixedly coupled with the 10 reel and having an oxygen outlet. A flexible oxygen hose fluidically intercouple the connector outlet with an oxygen mask. The unit also includes means for stowing the mask in a stowage position. The hose reel is selectively rotatable in a first direction for stowing successive portions of the oxygen 15 hose thereon as the oxygen mask is being shifted to the stowage position, and for selective rotation in an opposed second direction for delivering successive portions of the hose from the reel during 20 shifting of the mask toward an in-use position.

Preferably the hose reel is biased toward rotation in the first or stowage direction and the unit further includes a releasable reel stop coupled with the reel for releasably preventing rotation in 25 the first direction. The reel stop preferably takes the form of the pawl and the cam combination which prevents retraction of the hose during use once extended and which is preferably manually releasable by a crew member in order to wrap the oxygen hose around the reel for stowage.

30 The oxygen mask is desirably equipped with a microphone to allow a crew member to use the aircraft communication system while wearing the mask. Accordingly, the preferred unit hereof in-

1 cludes a rotary microphone connector having a fixed  
section coupled with the housing and including a  
first terminal for coupling with the aircraft com-  
5 munication system and a rotary section rotatably and  
electrically coupled with the fixed section and  
having a second terminal for electrically coupling  
with a microphone cable. The microphone cable  
electrically interconnects the microphone and the  
10 second terminal. The microphone cable and oxygen  
hose are preferably coupled in a side-by-side rela-  
tionship so that they are simultaneously stowed and  
delivered by the hose reel.

Other preferred aspects of the stowage  
unit are set forth hereinbelow.

15 Brief Description of the Drawing Figures

Fig. 1 is a perspective view of the pre-  
ferred stowage unit showing the oxygen mask and  
oxygen supply hose in their respective stowage  
positions;

20 Fig. 2 is a sectional view of the stowage  
unit shown in Fig. 1;

Fig. 3 is a plan view of the stowage unit;

Fig. 4 is a partial sectional view of the  
stowage unit of Fig. 1 with portions cut away for  
25 clarity illustrating the pawl and cam arrangement;  
and

Fig. 5 is a partial perspective view of  
the interior of an aircraft illustrating the stowage  
unit in use by an aircraft crew member.

30 Detailed Description of the Preferred Embodiment

Referring now to the drawing figures, and  
in particular to Figs. 1, 2, and 3, stowage unit 10  
includes housing 12, hose reel 14, hose reel mount-

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1        ing assembly 16, rotary oxygen connector 18, oxygen  
hose 20, oxygen mask 22, and microphone electrical  
assembly 24.

5        Housing 12 includes bottom wall 26 and  
four side walls 28 presenting an open top. Walls 26  
and 28 are preferably composed of aluminum or other  
lightweight metal. Housing 12 also includes a pair  
of mask-holding doors 30 and 32 which are coupled to  
opposing side walls 28 adjacent the top thereof by  
10        respective door hinges 34, and a pair of outwardly  
extending mounting flanges 36 and 38 (Figs. 1 and 3)  
coupled to opposed sidewalls near the top thereof  
adjacent respective door hinges 34. Doors 30 and 32  
open upwardly and are shown in the open position in  
Fig. 5 and in the closed position in Figs. 1-4, and  
15        are configured to cooperatively define mask stowage  
opening 40. Doors 30, 32 are preferably composed of  
synthetic resin material.

Hose reel 14 is preferably composed of  
aluminum and/or other synthetic resin material and  
20        presents a spool-shaped configuration for wrapping  
oxygen supply hose 20 therearound as shown in Fig.  
2. Reel 14 is configured to present a central  
tubular body 42 having respective left and right  
flanges 44 and 46 coupled to opposed ends thereof  
25        (Fig. 2). Right flange 46 includes structure defin-  
ing an axially aligned mounting bushing 47 and four  
ratchet cams 48 around the periphery of bushing 47  
on the outboard side of flange 46.

Hose reel mounting assembly 16 is designed  
30        to rotatably mount hose reel 14 within the housing  
12 and includes left mounting structure 49, right  
mounting structure 50, aluminum sheet metal enclos-  
ure 52 (preferably aluminum), and coil spring 54.

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1 Left mounting structure 49 includes mount-  
ing block 56 configured to define right-angled  
delivery passage 58 therein which includes connector  
opening 60 and internally threaded, oxygen inlet 62.  
5 Mounting block 56 along with connector opening 60  
and oxygen inlet 62 make up fixed portion 64 of  
rotary oxygen connector 18 as will be explained  
further hereinbelow.

Right mounting structure 50 includes base  
70, externally threaded shaft extension 72 coupled  
10 thereto and received through bushing 47 as shown in  
Fig. 2, lock nut 74, and coupling piece 76 extending  
inwardly and coaxially from extension 72.

Enclosure 52 presents a generally C-shaped  
configuration opening upwardly as shown and designed  
15 to fit snugly adjacent bottom wall 26 and sidewalls  
28 with left and right mounting structures 49, 50  
respectively coupled thereto which allows hose reel  
mounting assembly 16 to be treated as a unitary  
structure and dropped into place within housing 12.

20 Biasing spring 54 is a conventional rib-  
bon-type, wind-up or "clock" spring having its  
inboard end coupled to attaching piece 76 and the  
outboard end coupled with the interior surface of  
reel tubular body 42.

25 Hose reel 14 is rotatable in a first or  
stowage direction (the top of reel 14 into the page  
as viewed in Fig. 2) and a second, opposed, direc-  
tion so that reel rotation in the second direction  
winds spring 54 in order to bias hose reel 14 in the  
stowage direction.

30 Rotary oxygen connector 18 includes fixed  
portion 64 as described above and L-shaped rotary  
portion 80 having oxygen passage 82 defined there-  
through which includes externally threaded central

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1 block 84, outlet pipe 86 connected at a right angle  
thereto terminating at oxygen outlet 88, and O-ring  
90.

5 Central block 84 is threadably received  
through and axially aligned with a corresponding,  
internally threaded, axially aligned hole defined in  
left flange 44 so that a portion of central block 82  
extends into connector opening 60 with O-ring 90  
providing a seal therebetween. Outlet pipe 86  
10 extends through the wall of reel tubular body 42 and  
terminates on the outboard side thereof at oxygen  
outlet 88. Oxygen passage 82 fluidically inter-  
couples oxygen outlet 88 with connector opening 60  
and thereby with oxygen inlet 62 for connection to  
an aircraft oxygen source 92.

15 Conventional, flexible, oxygen hose 20  
fluidically interconnects oxygen outlet 88 with  
conventional oxygen mask 22 for delivery of oxygen  
from outlet 88 to the mask 22. The flexible nature  
of hose 20 allows successive portions thereof to be  
20 wrapped around reel tubular body 42 during rotation  
of reel 14 in the stowage direction thereby placing  
those portions of hose 20 in a stowage position  
thereon as mask 22 is moved toward its stowage  
position. Conversely, when a user grasps mask 22  
25 and pulls it upwardly toward an in-use position, the  
bias of spring 54 is overcome causing reel 14 to  
rotate in the opposed second direction for deliver-  
ing successive portions of hose 20 to an extended  
position.

30 In order to prevent biasing spring 54 from  
exerting a constant tension on hose 20 when mask 22  
is in use, stowage unit 10 also includes pawl 94  
presenting lever arm 96 and engagement tip 98 (Fig.  
4). Pivot pin 100 pivotally and shiftably mounts  
35



1 pawl 94 to the interior of enclosure 52 and pawl  
spring 102 biases pawl 94 toward a stop position.  
In the stop position, engagement tip 98 engages a  
5 respective ratchet cam 48 in order to prevent rota-  
tion of reel 14 in the stowage direction while so  
engaged. This prevents biasing spring 54 from  
exerting a constant tension on hose 20 while mask 22  
is being used. Lever arm 96 extends upwardly  
through slot 103 defined in enclosure 52.

10 When the use of mask 22 is complete, the  
crew member reaches within housing 12, shifts lever  
arm 96 and thereby pawl 94 to the release position  
allowing the bias of spring 54 to rotate reel 14 in  
the stowage direction to wrap hose 20 therearound  
for stowage.

15 Oxygen hose 20 also includes an externally  
mounted, tubular, stop ring 104 coupled therewith  
four or five inches from mask 22 and an oxygen flow  
indicator 105 coupled in-line between ring 104 and  
mask 22. Stop ring 104 is positioned above hose  
20 guide 106 which is coupled to housing 12 in order to  
stop shifting of hose 20 when stop ring 104 engages  
hose guide 106. That is to say, hose guide 106  
presents an eyelet 108 or opening therein having a  
diameter sufficient for hose 20 to pass therethrough  
25 but insufficient for stop ring 104 to pass there-  
through. This provision prevents biasing spring 54  
from exerting a constant tension on the connection  
between hose 20 and mask 22 when in the respective  
stowage positions as shown in Fig. 2. This constant  
tension might otherwise weaken the connection and  
30 possibly pull hose 20 from oxygen mask 22.

In the typical aircraft environment, a  
crew member must be able to use the aircraft commun-  
ication system while wearing oxygen mask 22. Ac-

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1 cordingly, microphone electrical assembly 24 in-  
cludes microphone 110 included in mask 22, micro-  
phone cable 112, electrical connector 114, and a  
5 cable connection jack 116 for conventional coupling  
with the aircraft communication system 118.

Electrical connector 114 is a conventional  
unit and includes a rotatable section 120 which is  
preferably attached to the inboard end of central  
block 84 and includes electrical terminal 122 locat-  
10 ed adjacent oxygen outlet 88. Connector 114 also  
includes fixed section 124 which is coupled to and  
extends inwardly from attaching piece 76 and is  
received within and electrically engages rotatable  
section 120. Cable length 126 electrically inter-  
couples fixed section 124 with connection jack 116.

15 Microphone cable 112 electrically inter-  
connects microphone 110 with electrical terminal 122  
and preferably presents the same length as hose 20  
and is coupled thereto in a side-by-side relation-  
ship so that hose 20 and microphone cable 112 are  
20 simultaneously stowed and payed out from hose reel  
14.

Figs. 1, 2, and 3 illustrate mask 22, hose  
20, and cable 112 in their respective stowage posi-  
tions. In these positions, hose 20 and cable 112  
25 are wrapped around hose reel 14 to the limit allowed  
by stop ring 104 as it engages the upper portion of  
hose guide 106. In the stowage position, the larger  
portion of mask 22 is contained within housing 12  
below the level of doors 30, 32. Mask stowage  
opening 40 defined by the configuration of doors 30,  
30 32 allows the sides of mask 22 to be engaged by the  
inboard edges thereof to suspend mask 22 in place as  
shown in the drawing figures with an upper portion

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1        thereof exposed through mask stowage opening 40 for  
grasping by a crew member.

5                Stowage unit 10 can be readily installed  
in an aircraft in place of the typically existing  
stowage box. Housing 12 is designed as a "drop in"  
unit and once in place, mounting flanges 36, 38  
engage the upper surface of the aircraft console or  
panel with appropriate screws holding flanges 36, 38  
in place. After stowage unit 10 is in place, the  
10        existing aircraft oxygen source 92 is connected to  
oxygen inlet 62 and the aircraft communication  
system 118 is connected to jack 116.

15                To use mask 22, a crew member grasps the  
exposed portion thereof and pulls upwardly which  
action opens doors 30, 32 and extends the desired  
length of oxygen hose 20 and cable 112 which, in  
turn, causes hose reel 14 to rotate in the second  
direction thereby paying out the needed lengths.  
During this process, pawl 94 continually slides over  
successive ratchet cams 48. When hose 20 and cable  
20        112 are pulled to the desired length, engagement tip  
98 engages a respective cam 48 to hold against the  
bias of biasing spring 54. The mask is then placed  
on the user's head as shown in Fig. 5.

25                After use, the crew member reaches in  
housing 12 and shifts lever arm 96 against the bias  
of pawl spring 102 which allows biasing spring 54 to  
rotate hose reel 14 in the stowage direction thereby  
wrapping successive portions of hose 20 and cable  
112 thereabout until stop ring 104 engages hose  
30        guide 106 at which point hose 20 and cable 112 are  
in their stowage positions. The user then places  
mask 22 in the stowage position as shown in Figs.  
1-3 and closes doors 30, 32 therearound to hold mask  
22 in its stowage position.

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1                   Having thus described the preferred em-  
bodiment in the present invention, the following is  
claimed as new and desired to be secured by Letters  
Patent:

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1        Claims:

1.    A crew oxygen mask and supply hose stowage unit comprising:

     a housing;

5       a hose reel;

     mounting means rotatably mounting said reel within said housing;

     a rotary oxygen connector including--

10       a fixed portion coupled with said housing and including structure defining an oxygen inlet for coupling with an oxygen source, and

15       a rotary portion rotatably and fluidically coupled with said fixed portion and fixedly coupled with said reel and presenting an oxygen outlet for delivering oxygen from said inlet to said outlet and for rotary motion of said rotary portion and reel relative to said fixed portion and housing;

20       an oxygen mask;

     a flexible oxygen hose fluidically intercoupling said outlet and mask; and

25       mask stowage means coupled with said housing for releasably stowing said mask in a mask stowage position, said mask being shiftable between said mask stowage position and an in-use position,

30       said mounting means including means for selective rotation of said reel in a first direction for stowing successive portions of said hose on said reel in a hose stowage position during shifting of said mask toward said mask stowage position, and for selective rotation in an opposed, second

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direction for paying out successive portions of said hose from said reel to an extended position during shifting of said mask toward said in-use position.

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2. The stowage unit as set forth in claim 1, further including biasing means biasing said reel toward rotation in said first direction.

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3. The stowage unit as set forth in claim 2, further including releasable reel stop means coupled with said reel for releasably preventing rotation in said first direction.

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1                   4. The stowage unit as set forth in  
claim 1, said mask including a microphone, said unit  
further including:

a rotary, microphone connector including --

5                   a fixed section coupled with said housing  
and including first terminal means  
for electrically coupling with a  
communication system of an aircraft,  
and

10                  a rotary section rotatably and electrical-  
ly coupled with said fixed section  
and having a second terminal means  
electrically coupled with said first  
terminal means and for electrically  
15                  coupling with the microphone cable;  
and

a microphone cable electrically interconnecting  
said microphone and said second terminal  
means and thereby with said first terminal  
20                  means for electrically connecting said  
microphone with the communication system  
of an aircraft,

said reel including structure for storing  
successive portions of said cable thereon  
25                  during rotation in said first direction  
during shifting of said mask toward said  
mask stowage position, and for paying out  
successive portions of said cable during  
rotation of said reel in said second  
30                  direction during rotation of said reel in  
said second direction during shifting of  
said mask toward said in-use position.

1                   5. The stowage unit as set forth in  
claim 4, said unit including means arranging said  
hose and cable in a side-by-side relationship for  
simultaneous, adjacent storing and paying out.

5                   6. The stowage unit as set forth in  
claim 1, said unit including hose stop means for  
limiting the movement of said hose toward said  
stowage position.

10                   7. The stowage unit as set forth in  
claim 6, said hose stop means including a hose guide  
coupled with said housing having structure defining  
a hose opening therethrough for shifting of the hose  
15                   therethrough and including a stop structure coupled  
with said hose near said mask, said stop structure  
presenting a greater diameter than said hose aper-  
ture for engaging said guide and thereby limiting  
the shifting of said hose toward said stowage posi-  
20                   tion.

                  8. The stowage unit as set forth in  
claim 1, said housing including a mask holder means  
coupled therewith for storing said mask in a mask  
25                   stowage position.

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1           9. The stowage unit as set forth in  
claim 8, said mask holder means including a pair of  
holder doors hingedly coupled with said housing and  
shiftable between respective open and closed posi-  
5       tions, said doors, when in said closed position,  
cooperatively presenting structure for holding said  
mask therebetween and for presenting at least a  
portion of said mask for grasping and removal by a  
user, said doors shifting to said open position as  
10       the user removes said mask from said mask stowage  
position.

          10. The stowage unit as set forth in  
claim 1, said unit including oxygen flow indicator  
15       means disposed within said hose for visually indi-  
cating flow of oxygen in said hose.

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1                    11. A crew oxygen mask and supply hose  
stowage unit comprising:

a housing;

an oxygen mask;

5                    an elongated, flexible, oxygen hose having an  
oxygen outlet end fluidically coupled with  
said mask and an opposed oxygen inlet end;  
inlet coupling means for fluidically coupling  
the oxygen inlet of said hose end with an  
10                   oxygen source;

mask stowage means operably coupled with said  
housing for storing said mask in a mask  
stowage position at least partially within  
the confines of said housing, said mask  
15                   being shiftable between said mask stowage  
position and an in-use position wherein  
the mask is in an extended position  
outside of said housing and oriented for  
wearing by a user, said hose remaining  
20                   coupled with said mask during said  
shifting and use of the mask; and

retraction means for retracting successive  
portions of said elongated hose into said  
housing and into a hose-storage position  
during shifting of said mask toward and  
25                   into said mask stowage position, and for  
paying out successive portions of said  
hose from said housing to an extended  
position of the hose during shifting of  
30                   said mask toward said in-use position.

12. The unit as set forth in claim 11, said  
retraction means including hose support means located  
within said housing for supporting at least a portion of  
35                   said hose in a coiled configuration when said hose in  
said hose storage position.

1                   13.     The unit as set forth in claim 12, said  
hose support means including reel means rotatably mounted  
within said housing for wrapping said hose portion  
thereabout in order to place said hose in said coiled  
5                   configuration.

                  14.     The unit as set forth in claim 11, said  
retraction means including a fixed portion coupled with  
said housing, a rotary portion rotatably coupled with  
10                  said fixed portion for wrapping of said flexible hose  
therearound, and means biasing said rotary portion in a  
direction for wrapping said flexible hose therearound.

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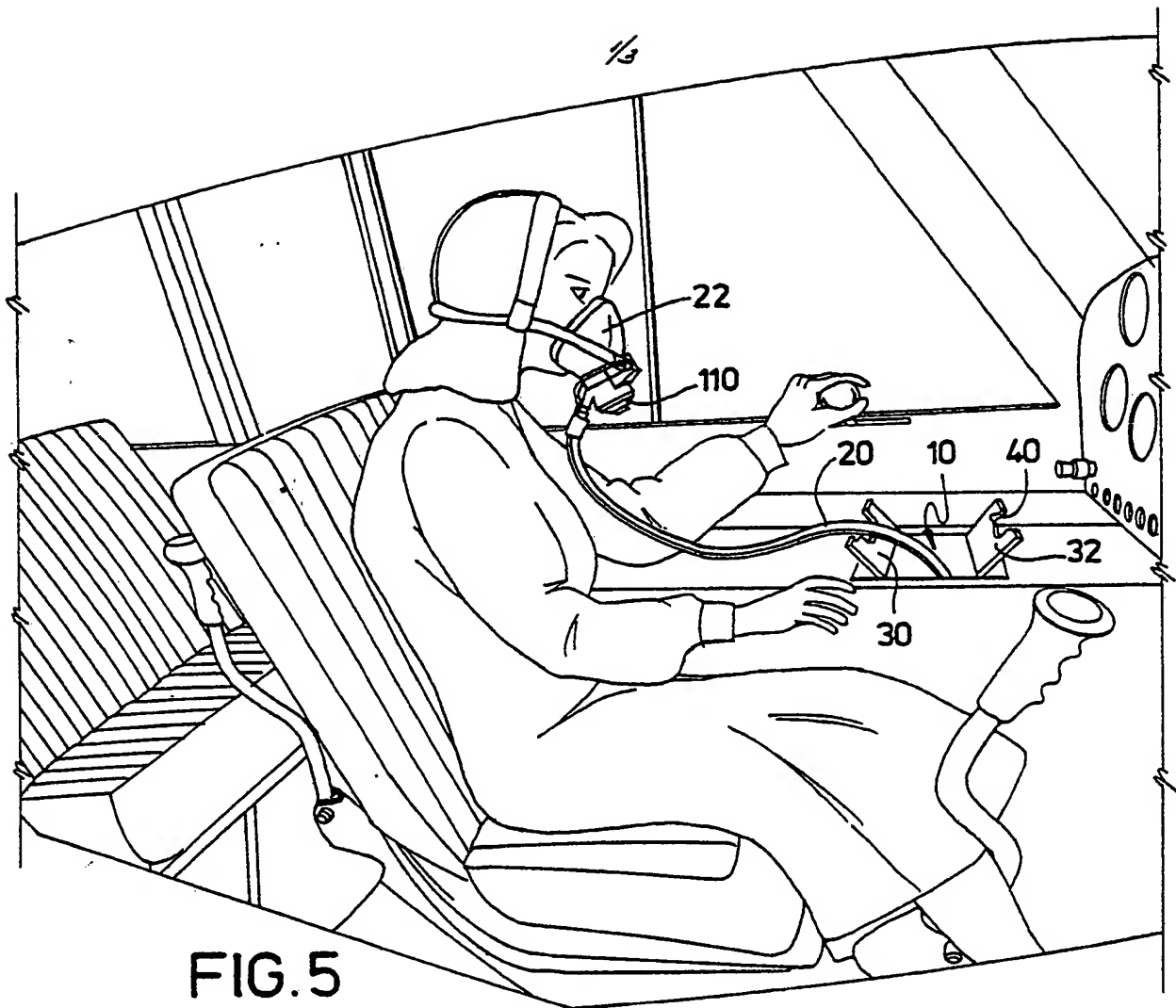


FIG. 5

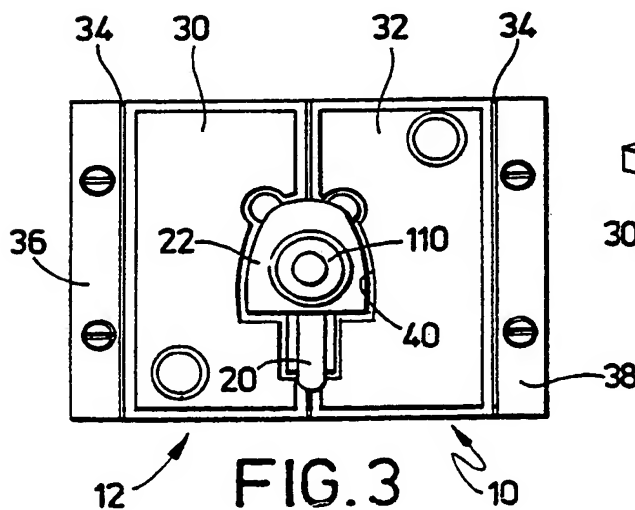


FIG. 3

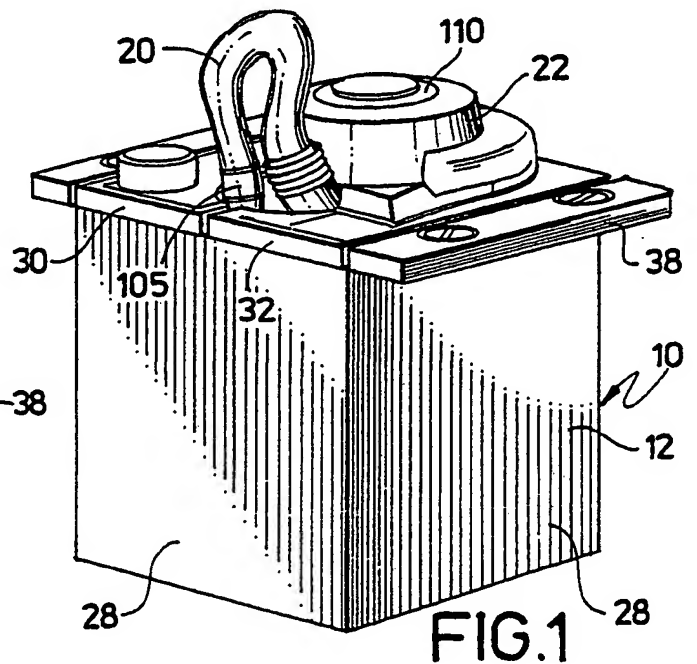
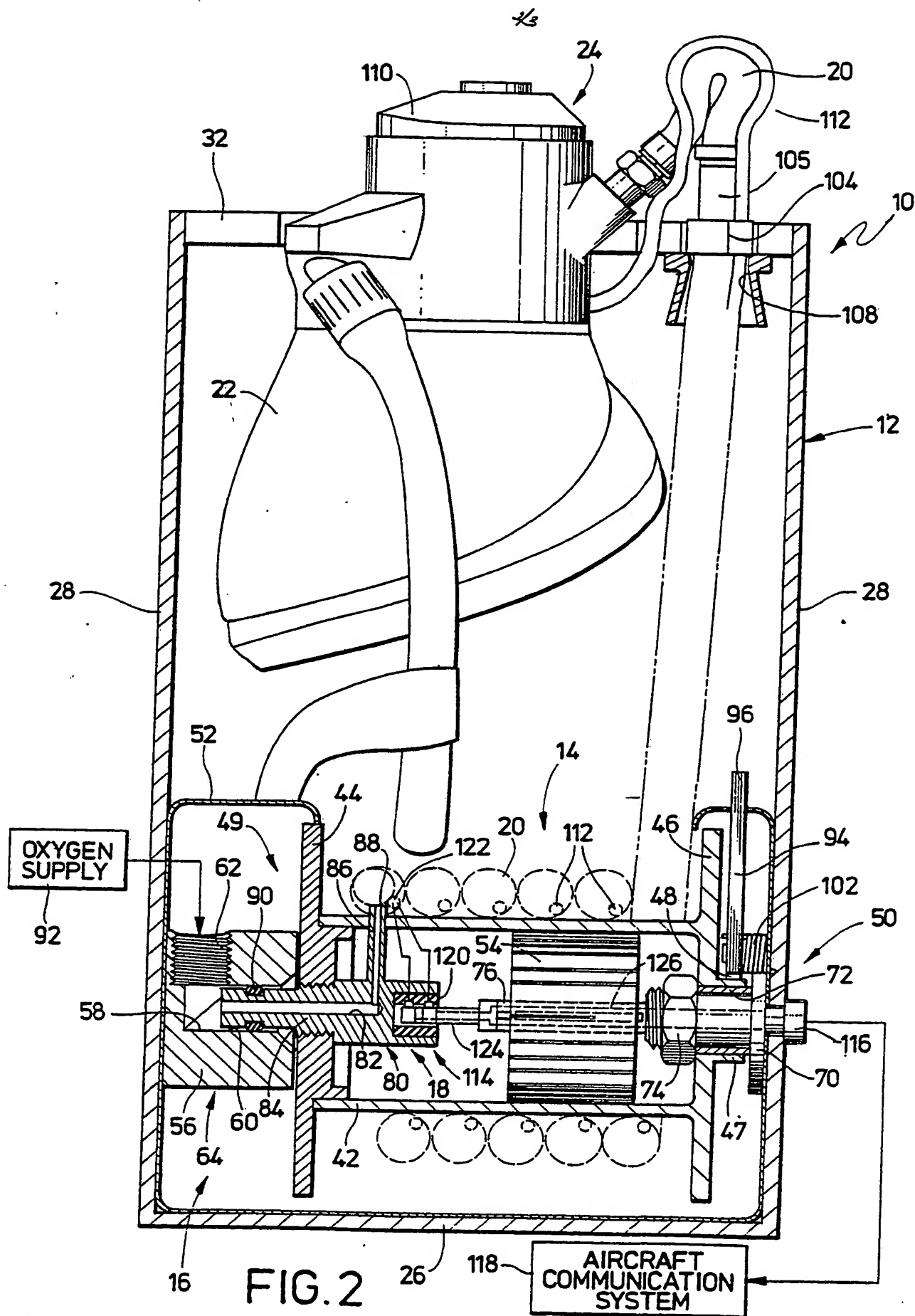
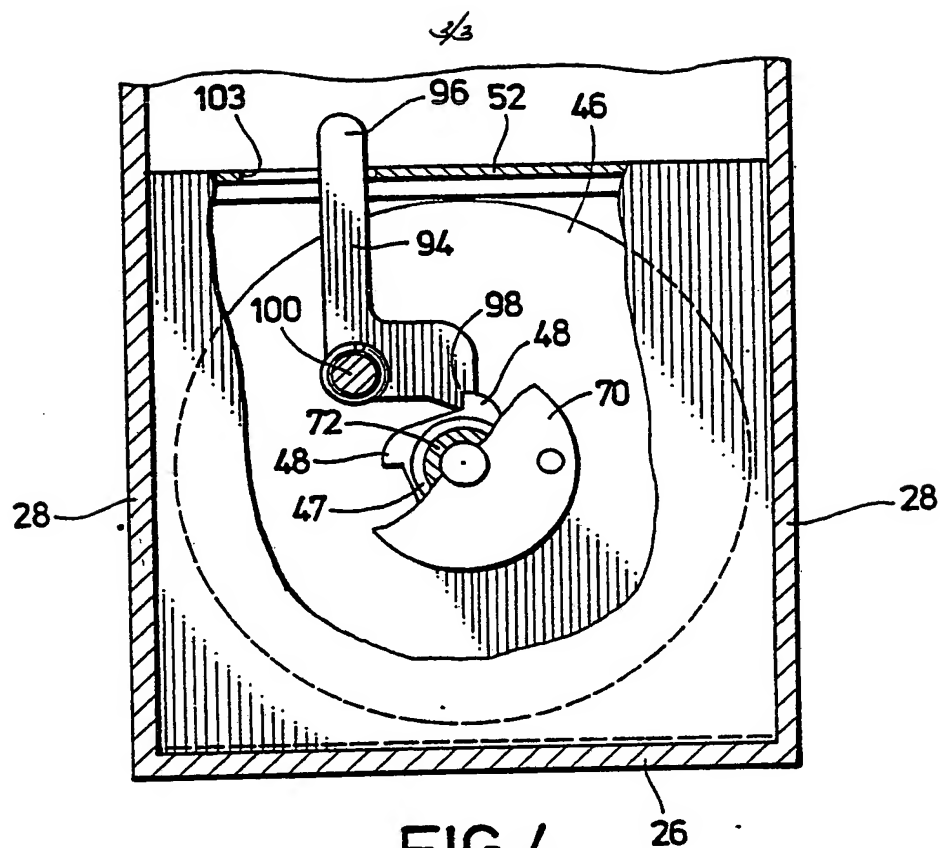


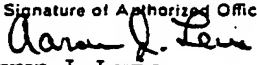
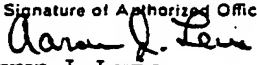
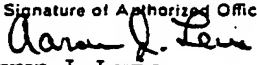
FIG. 1





# INTERNATIONAL SEARCH REPORT

International Application No. PCT/US89/03856

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (if several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC INT. CL. (4) A62B 18/00, 18/08 B65H 75/34, 75/38, 75/48 U.S. CL. 128/201.19, 206.27; 242/86, 107.6																				
<b>II. FIELDS SEARCHED</b> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched <sup>7</sup></div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; border-bottom: 1px solid black;">Classification System</th> <th style="border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="padding: 5px;">U.S. CL.</td> <td style="padding: 5px;">128/201.19, 206.27; 242/86, 107.6</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched <sup>8</sup></div>			Classification System	Classification Symbols	U.S. CL.	128/201.19, 206.27; 242/86, 107.6														
Classification System	Classification Symbols																			
U.S. CL.	128/201.19, 206.27; 242/86, 107.6																			
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup></b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border-bottom: 1px solid black;">Category <sup>*</sup></th> <th style="border-bottom: 1px solid black;">Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup></th> <th style="width: 15%; border-bottom: 1px solid black;">Relevant to Claim No. <sup>13</sup></th> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US,A, 3,073,301 (HAY ET AL). 15 JANUARY 1963. See Fig. 1.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-3, 6-8, 10</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US,A, 1,993,617 (NASON), 05 MARCH 1935. See Figs. 1 and 2.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">1-3,6-8,10-14</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US,A, 989,534 (MACDUFFEE), 11 APRIL 1911. See Figs. 1 and 3.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">4,5</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">Y</td> <td style="padding: 5px;">US,A, 3,315,674 (BLOOM ET AL), 25 APRIL 1967. See Fig. 1.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">4,5</td> </tr> <tr> <td style="text-align: center; vertical-align: top; padding: 5px;">X Y</td> <td style="padding: 5px;">US,A, 4,154,237 (COURTIER), 15 MAY 1979. See Figs. 2 and 3.</td> <td style="text-align: center; vertical-align: top; padding: 5px;">11,12 13,14</td> </tr> </table>			Category <sup>*</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>	Y	US,A, 3,073,301 (HAY ET AL). 15 JANUARY 1963. See Fig. 1.	1-3, 6-8, 10	Y	US,A, 1,993,617 (NASON), 05 MARCH 1935. See Figs. 1 and 2.	1-3,6-8,10-14	Y	US,A, 989,534 (MACDUFFEE), 11 APRIL 1911. See Figs. 1 and 3.	4,5	Y	US,A, 3,315,674 (BLOOM ET AL), 25 APRIL 1967. See Fig. 1.	4,5	X Y	US,A, 4,154,237 (COURTIER), 15 MAY 1979. See Figs. 2 and 3.	11,12 13,14
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p><sup>*</sup> Special categories of cited documents: <sup>10</sup></p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&amp;" document member of the same patent family</p> </div> </div>																				
<b>IV. CERTIFICATION</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of the Actual Completion of the International Search</td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;">Date of Mailing of this International Search Report</td> </tr> <tr> <td style="text-align: center; padding: 5px;">03 November 1989</td> <td style="text-align: center; padding: 5px;">06 DEC 1989</td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;">International Searching Authority</td> <td style="border-bottom: 1px solid black; padding: 5px;">Signature of Authorized Officer</td> </tr> <tr> <td style="text-align: center; padding: 5px;">IS A/US</td> <td style="text-align: center; padding: 5px;">             Aaron J. Lewis         </td> </tr> </table>			Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	03 November 1989	06 DEC 1989	International Searching Authority	Signature of Authorized Officer	IS A/US	 Aaron J. Lewis										
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